Particle size distribution and mineralogy of Brazilian Ferralsols: Significance for the structure and hydraulic properties.

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Significance for the structure and hydraulic properties

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The Cerrados Biome is one of the major regions of Brazil with 24% of the Brazilian territory (204.10^6 ha). It is mainly located in the center of Brazil and corresponds to the whole Central Plateau. About 49% of the soils are Ferralsols and approximately 79.10^6 ha of these soils are dedicated to agriculture. The main characteristics of Ferralsols are a poor horizonation, a weak development of the macrostructure, and a strong submillimetric granular microstructure. The objective of this work was to evaluate the influence of the mineralogy on the structure and hydraulic properties of Ferralsols. The Ferralsols (F) studied were selected according to the mineralogy of the $<2\mu m$ fraction along a regional topossequence across the Brazilian Central Plateau. The soils F1, F2, F3 and F4 were located on the South American Surface and F5 and F6 on the upper Velhas Surface, F7 and F8 on the intermediate Velhas Surface, F9 and F10 on the lower Velhas Surface. A semi quantify method was used to compare the mineralogy of the clay fraction. Chemical composition obtained with from sulfuric acid extraction was used to estimate the kaolinite, gibbsite, goethite and hematite content. Goethite and hematite content was also estimated using the soil color (hue, value and chrome). The soil-water retention curve was determined by using undisturbed samples, using the centrifugation method at -1, -6, -10, -33, -300, and -1500 kPa. The saturated hydraulic conductivity was determined in the field using the Guelph permeameter procedure. The Ferralsols studied were classified in according to the RKGb ratio.They are gibbsitic for the soils F1, F2, F3, and F4 and kaolinitic for the soils F5, F6, F7, F8, F9, and F10. Results did not reveal a clear link between the mineralogy and the development of structures that for all diagnostic horizons a weak compound medium sub - angular blocky and strong very fine granular structure. The little differences of structure observed between the soils studied were attributed to the nodules. The clay content ranged from 520 to 780 $g.kg^{-1}$, except for F4 where it was 300 $g.kg^{-1}$. Results also showed a relationship between the mineralogy, expressed in terms of RKGb, and the clay content, evidencing a positive correlation up to RKGb = 0.60 for F1, F2, F3 and F4, located on the South American Surface. Then, for RKGb>0.60, the clay content showed a decreasing trend (F5, F7, F8 and F9) on the Velhas Surface. That difference can be explained by difference of parental material and pedological evolution. The soils on the South American Surface are well developed and were derived from meta-sedimentary clastic rocks, while the soils on the Velhas Surface are less developed and they were derived from colluvial sediments originating from South American Surface. There is no correlation between the total porosity and clay content, the RKGb ratio and the saturated hydraulic conductivity. On the other hand the saturated hydraulic conductivity was positively correlated with the volume of pores with equivalent diameter >300µm.